Features of the Thermoelectrical Power in CuInSe2 Monocrystals.

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The results of research on thermoelectrical power (a) in CuInSe2 monocrystals in the temperature range 77-293 K before and after annealing are presented. The annealing monocrystals grown by the Brjdgmen method is carried out at T=550^{o}C for 3 hours in the air. Samples p- and n-CuInSe2 have a mobility mp=80 cm/B×c and mn=200 cm/B×c and a carriers concentration p=2×1016 cm-3 and n=5×1017 cm-3 at T=293K. On the temperature dependences of ap and an are observed minima at Tpmin=120K and Tnmin=140K. At Tpmax=220K and Tnmax=240K ap=0,769 mV and an=0,326 mV. The annealing leads to increase of ap and decrease of an and to low temperature smoothing of a maxima. The increase of a in a range 120K<T<220K for ap and 140K<T<240K for an is agreed with the theory of charge carriers transport by optic phonons [1]. The increase of ap at T<120K and an at T<140K can be explained by an effect of charge carriers transport by acoustic phonons. The a decreases at T>Tpmax (Tnmax). Authors [2] observed the analogous dependence for the mobility of charge carriers that is connected with rising of diffusion contribution on thermal lattice oscillations.

The annealing leads to decrease of defects concentration and “doping” by oxygen of air. This affects the increase of ap connected with rising of holes concentration and the decrease of an owing to reducing of electrons concentration. The smoothing of a minima can be explained by influence of crystal lattice defects bringing in by oxygen and rising of charge carriers diffusion.

[1] M.J. Fedorov, V.K. Zaitsev, V.V Popov., A.E. Kaleazin, M.A. Hazan, J.V. Ivanov Proc. of the XV Int. Conf. on Thermoelectrics. St.Petersburg, 92 (1997)
[2] K.I Bachmann., M. Fearheilei, Y. Shing, N. Tran Appl. Physics Lett. 44, N4, 407 (1984)